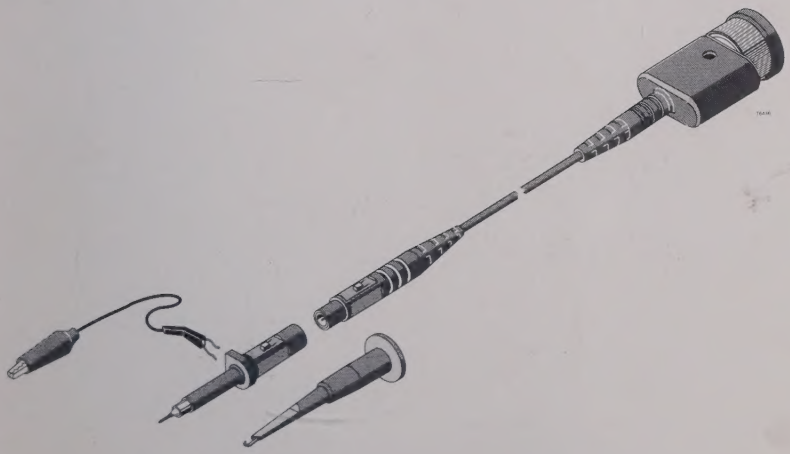
10:1 Passive Probes

PM9020

Instruction Manual



FLUKE®

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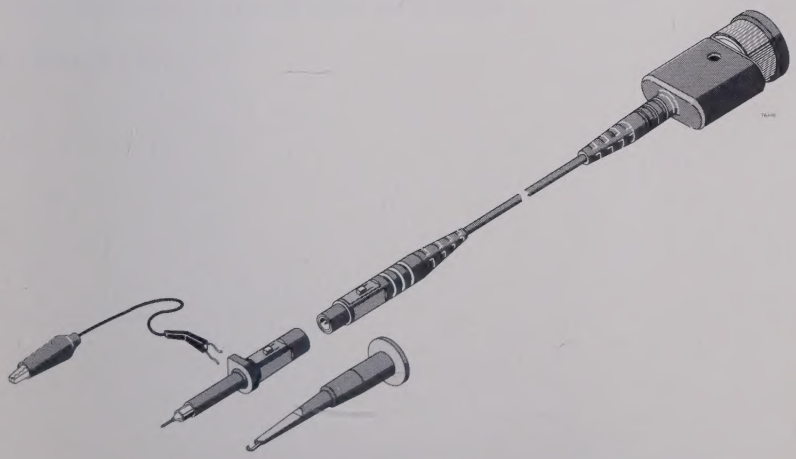
Instruction Manual *950131*



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1 INTRODUCTION

The PM 9020-series are 10x attenuator modular probes, of the PM 9000 probe family designed for oscilloscopes.
Depending on the probe version, two different types are available:

- PM 9020/001
- PM 9020/091

All types are provided with a GND switch that connects the probe input via a 9 MΩ resistor to ground.

Both probes consist of two separate units:

- The probe cable with compensation box having a BNC male connector output.
- The probe body including probe tip.

The PM9020/091 is also provided with range indicator and command switch.
The **range indicator** selects the attenuator range of the oscilloscope by means of a resistor and sets the AMPL/DIV reading by 10x.
The **command switch** starts an execution that can be selected with an utility menu in your oscilloscope.

Note: If your oscilloscope is not provided with one of these facilities, they have no function.

2 CHARACTERISTICS

- Properties expressed in numerical values with tolerances or limits stated, are guaranteed by the manufacturer.
- Numerical values without tolerances or limits represent the characteristics of an average probe.

2.1 Electrical

Note: These characteristics are valid with a termination of 1 MΩ oscilloscope input, unless otherwise stated.

designation	specification	additional info

2.1.1 Input

* Impedance

Parallel resistance	10 MΩ + or -1%	at d.c.
Parallel capacitance	12 pF	at oscilloscope input cap. 25 pF

* Input voltage

Max. input (d.c. + a.c. peak)	500V	
Test voltage (d.c.): performance check	2.414 kV	During 1s.

2.1.2 Output

* Connector BNC male

* Load

Osc. input resistance	1 MΩ
Compensation range	15 pF. . .35 pF
Adjustment at delivery	25 pF

designation	specification	additional info
2.1.3 Transmission		
* Attenuation (d.c.)	10x + or -2%	Tolerance of load excluded
* Bandwidth		
Useful system bandwidth at osc. input cap. of 25 pF or less	d.c. . . .200 MHz (-3 dB)	Note: Up to these freq. the system (probe + osc.) bandwidth is 95% of the ''osc. only'' bandwidth, provided that probe is well compensated for HF and LF.
* Pulse response		Aberrations in addition to osc. aberrations. Probe must be HF and LF compensated. Oscilloscope bandwidth equal to or less then useful system bandwidth. Stimulus: voltage transient of 1 ns rise time. Source impedance: 25Ω.
Max. overshoot	5%	
Max. ringing during first 30 ns	±4%	after transient
Max. ringing thereafter	±3%	
Max. tilt	2%	

2.2 Mechanical

* Length and mass		
Overall length	150 cm ±3 cm	including hook tip
Mass	145g 165g	for PM9020/001 for PM9020/091 Probe with accessories and manual in pouch.

2.3 Environmental

designation	specification	additional info
* Meets environmental requirements of	MIL-T-28800D Type III Class 3, style B	Unless otherwise stated
* Temperature		
operating	-10°C. . . +55°C	
storage	-51°C. . . +71°C	
* Maximum humidity	95% relative humidity	
* Maximum altitude		
operating	4 570m (15 000 feet)	
storage	12 000m (40 000 feet)	

2.4 Safety

* Meets requirements of	IEC 348 VDE 0411 UL 1244 CSA 22.2 No 231	
* Resistance to ground	less then 100 mΩ	Measured with a direct current of 20A between ground collar of probe body and ground collar of BNC connector.

2.5 Accessories

*	Accessory kit, contents:	- Retractable hook tip - Ground lead assy - Insulation cap - DIL insulation cap - Bayonet ground clip - Spare probe tip - Pcb connector - Marking rings (6pcs)
*	Instruction manual	

3 DESCRIPTION ACCESSORIES

Retractable hook tip:	For hands-free connection to a test point or component lead.
Ground lead:	To minimize ringing in a signal. This lead must **first** be plugged onto the probe body and then be connected to the nearest ground point of the circuit to be measured.
Insulation cap:	To cover the metal part of the probe during measurements in densely wired circuits.
DIL cap:	To measure on dual-in-line integrated circuits.
Bayonet ground clip:	To minimize ringing in VHF signals, when grounding must be as short as possible.
Probe tip:	A spare tip is standard supplied with the probe. When a probe tip is damaged it can be pulled out by means of a pair of pliers. Then a new tip must be firmly pushed in.
Pcb connector:	A probe tip socket that can be soldered on the pc board. It gives you hands-free connection to the circuit to be measured.
Marking rings:	To identify the specific probes when using more than one probe on an oscilloscope.

4 DISMANTLING AND REPLACING PROCEDURES

4.1 Disassembling the probe

The probe consists of two parts: the cable with compensation box and the probe body. This modular construction allows individual replacement of both parts. For this, they can be separated by sliding the probe body from the cable assembly.

4.2 Dismantling the compensation box

Although the compensation box is not repairable, it can be opened for the h.f. adjusting (see Section 5.3).
Dismantle with the following procedure:

1. Slide the rubber cover from the compensation box over the cable.
2. Slide the cap backwards over the cable off the compensation box.
3. The h.f. adjustment controls are then accessible.

WARNING: If adjustment of the h.f. controls is inevitable, it must be carried out only by a qualified person who is aware of the hazards involved.

4.3 Replacing the probe tip

When the probe tip is bent or broken, it can be replaced by a new one.

1. Pull out the damaged tip tightly from the probe body using a pair of pliers.
2. Install a new probe tip.

Note: Do not use tools (pliers, etc.) to install the probe tip to prevent damaging of the tip. If necessary you can increase grip on the probe tip barrel by winding a rubber band around the barrel several times.

5 ADJUSTMENT PROCEDURES

5.1 Introduction

The measuring probe has been adjusted and checked by the manufacturer. This probe requires two adjustment procedures:

- **low-frequency**, to match the probe to the input circuitry of your oscilloscope. This is necessary each time you first connect the probe to the oscilloscope.
- **high-frequency**, to get optimum square-wave response. This must be done periodically, according to maintenance schedules or after replacement.

5.2 Matching the probe to your oscilloscope

To match the probe to your oscilloscope, proceed with the following steps:

1. Connect the probe tip to the CAL-socket of the oscilloscope.
2. Turn the oscilloscope to on.
3. Set the scope to 0.2 V/div and 0.2 ms/div.
4. Ensure that the channel's input coupling is DC.
5. If the pulse shows overshoot or undershoot, correct this by using the trimmer in the probe's body.

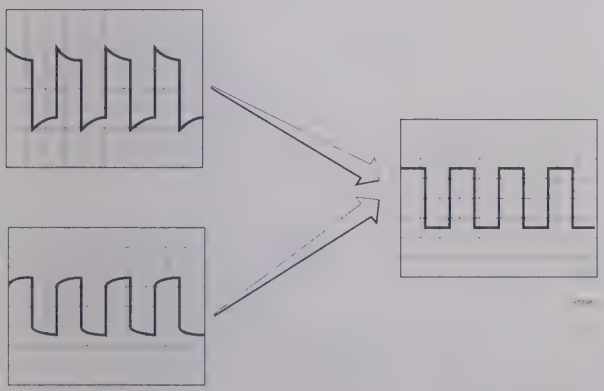

Figure 1 Adjust the probe to your oscilloscope

5.3 Adjusting the HF step response

WARNING: If adjustments of the hf controls is inevitable, it must be carried out only by a qualified person who is aware of the hazards involved.

For adjustment, proceed with the following steps:

1. Dismantle the compensation box, see Section 4.2.
2. Connect the BNC output to the oscilloscope and switch the oscilloscope on.
3. Connect the probe tip to a fast pulse generator (rise-time not exceeding 1 ns), which is terminated by its characteristic impedance.
4. Set the oscilloscope to 0.2 V/div and 20 ns/div.
5. Ensure that the channel's input coupling is DC.
6. Adjust the generator output for a 5 div/100 kHz pulse.
7. Set all potentiometers fully clockwise.
6. Adjust the adjusting elements for optimum square-wave response.

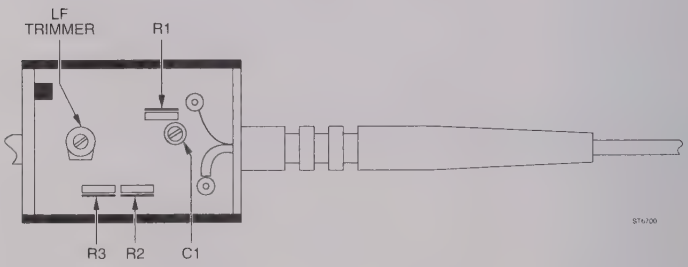

Figure 2 Adjusting elements

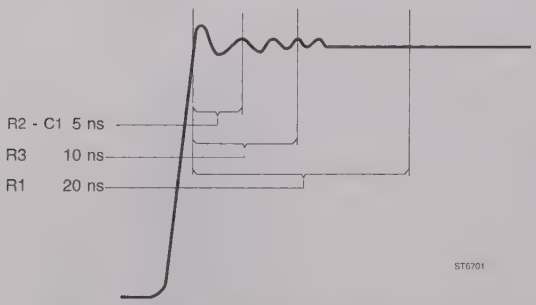

Figure 3 Adjusting elements vs square-wave response

6 PARTS LIST

Item	Ordering code	Description
1	5322 264 20089	Probe body
2	5322 321 61308	Cable assembly for PM9020/001 This cable assembly has no range indicator and command switch!
	5322 321 61307	Cable assembly for PM9020/091
3	5322 325 10137	Retractable hook tip
4	5322 321 23063	Ground lead
5	5322 462 41857	Insulation cap
6	5322 462 41319	DIL insulation cap
7	5322 265 20528	Probe tip
8	5322 462 41318	Bayonet ground clip
9	5322 265 20529	Pcb connector

Figure 4 Probe with accessories

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NOTES

NOTES

This bag contains:

☐ **PM 9020/001**

☑ **PM 9020/091**

4822 872 03381